

1/15

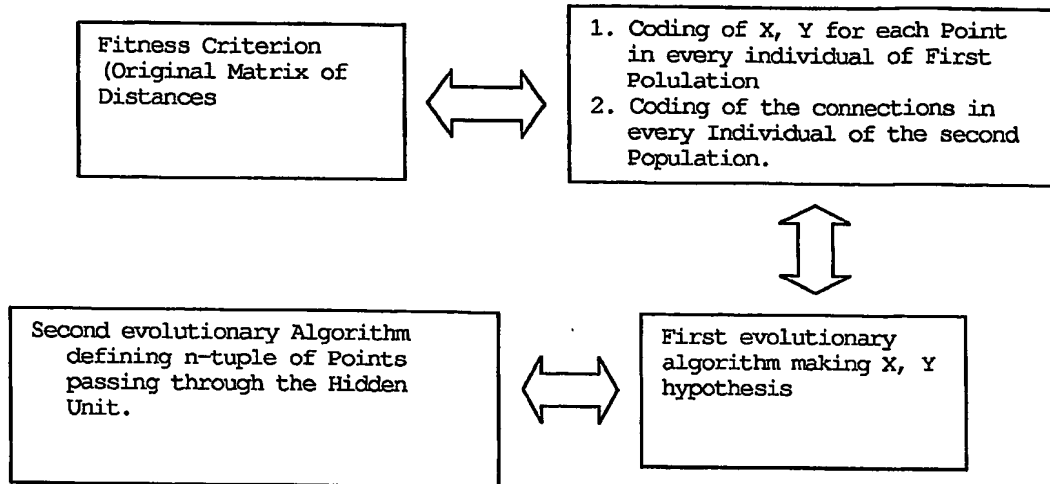


Fig. 1

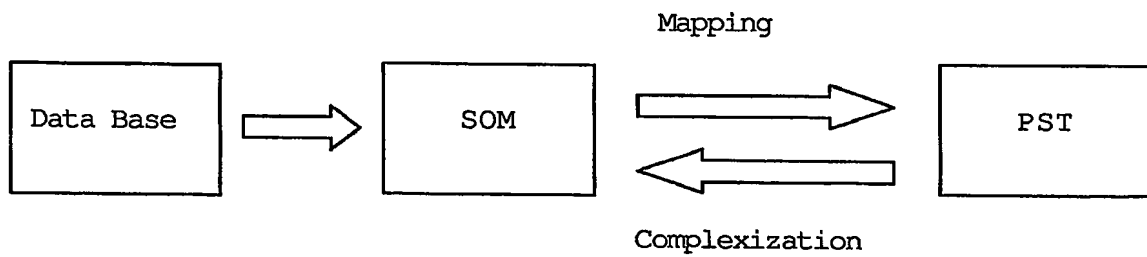


Fig. 2

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Example (1)

HIDDEN

|             | Hidden      |        |       |        |        |      |          |      |         |           |
|-------------|-------------|--------|-------|--------|--------|------|----------|------|---------|-----------|
|             | Alessandria | Ancona | Aosta | Arezzo | Ascoli | Asti | Avellino | Bari | Belluno | Benevento |
| Alessandria | 0           |        |       |        |        |      |          |      |         |           |
| Ancona      | 465         | 0      |       |        |        |      |          |      |         |           |
| Aosta       | 165         | 617    | 0     |        |        |      |          |      |         |           |
| Arezzo      | 389         | 192    | 550   | 0      |        |      |          |      |         |           |
| Ascoli      | 576         | 122    | 728   | 249    | 0      |      |          |      |         |           |
| Asti        | 37          | 491    | 159   | 420    | 602    | 0    |          |      |         |           |
| Avellino    | 824         | 437    | 985   | 456    | 365    | 855  | 0        |      |         |           |
| Bari        | 919         | 465    | 1071  | 661    | 400    | 945  | 208      | 0    |         |           |
| Belluno     | 441         | 454    | 534   | 426    | 565    | 468  | 861      | 908  | 0       |           |
| Benevento   | 805         | 395    | 966   | 431    | 323    | 836  | 42       | 197  | 842     | 0         |

Highway Distances in a geographic space between 10 Italian Cities (in Km)  
 Every highway has three types of alteration in a 2D Euclidean space:

- 1) A longitudinal alteration
- 2) An altitude alteration:
- 3) A structural alteration

Fig. 3

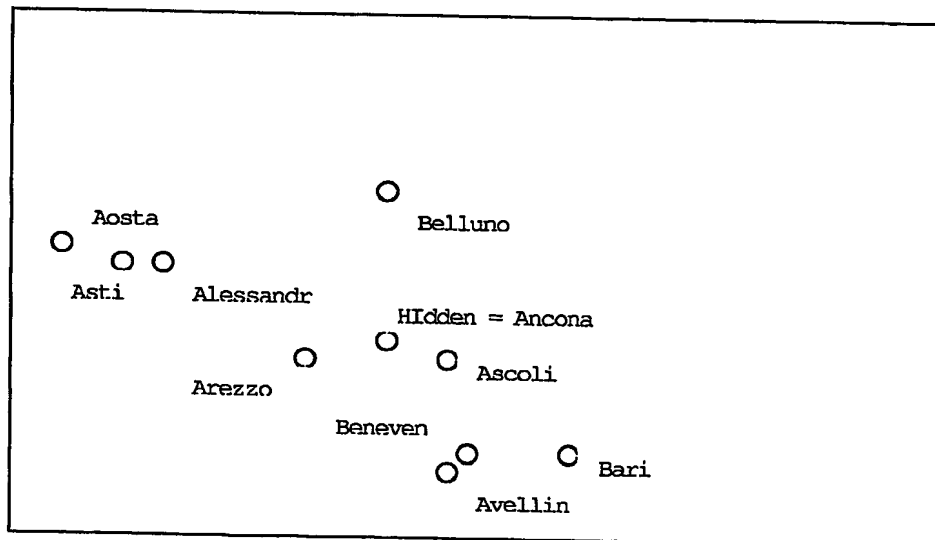


Fig. 4

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**Example (2)**

|             | LA   | NY   | BOSTON | DETROIT | BUFFALO | PITTSBURG | CHICAGO | SAINT_LOUIS | CINCINNATI | DALLAS | ATLANTA | MEMPHIS |
|-------------|------|------|--------|---------|---------|-----------|---------|-------------|------------|--------|---------|---------|
| LA          | 0    |      |        |         |         |           |         |             |            |        |         |         |
| NY          | 5600 | 0    |        |         |         |           |         |             |            |        |         |         |
| BOSTON      | 6109 | 509  | 0      |         |         |           |         |             |            |        |         |         |
| DETROIT     | 4582 | 1145 | 1527   | 0       |         |           |         |             |            |        |         |         |
| BUFFALO     | 5091 | 764  | 1018   | 509     | 0       |           |         |             |            |        |         |         |
| PITTSBURG   | 4836 | 764  | 1145   | 509     | 382     | 0         |         |             |            |        |         |         |
| CHICAGO     | 4073 | 1655 | 2036   | 509     | 1018    | 891       | 0       |             |            |        |         |         |
| SAINT_LOUIS | 3564 | 2036 | 2418   | 1018    | 1527    | 1273      | 636     | 0           |            |        |         |         |
| CINCINNATI  | 4327 | 1273 | 1655   | 382     | 764     | 509       | 509     | 764         | 0          |        |         |         |
| DALLAS      | 2800 | 2927 | 3436   | 2036    | 2545    | 2291      | 1655    | 1018        | 1782       | 0      |         |         |
| ATLANTA     | 4327 | 1527 | 2036   | 1145    | 1400    | 1018      | 1145    | 1018        | 764        | 1527   | 0       |         |
| MEMPHIS     | 3564 | 2164 | 2545   | 1273    | 1782    | 1400      | 1018    | 382         | 891        | 891    | 764     | 0       |

Flight Distances in a geographic space between 12 USA Cities (in miles)  
 Every air route has three types of alteration in a 2D Euclidean space:

- 1) A longitudinal alteration
- 2) An altitude alteration:
- 3) A structural alteration

Fig. 5

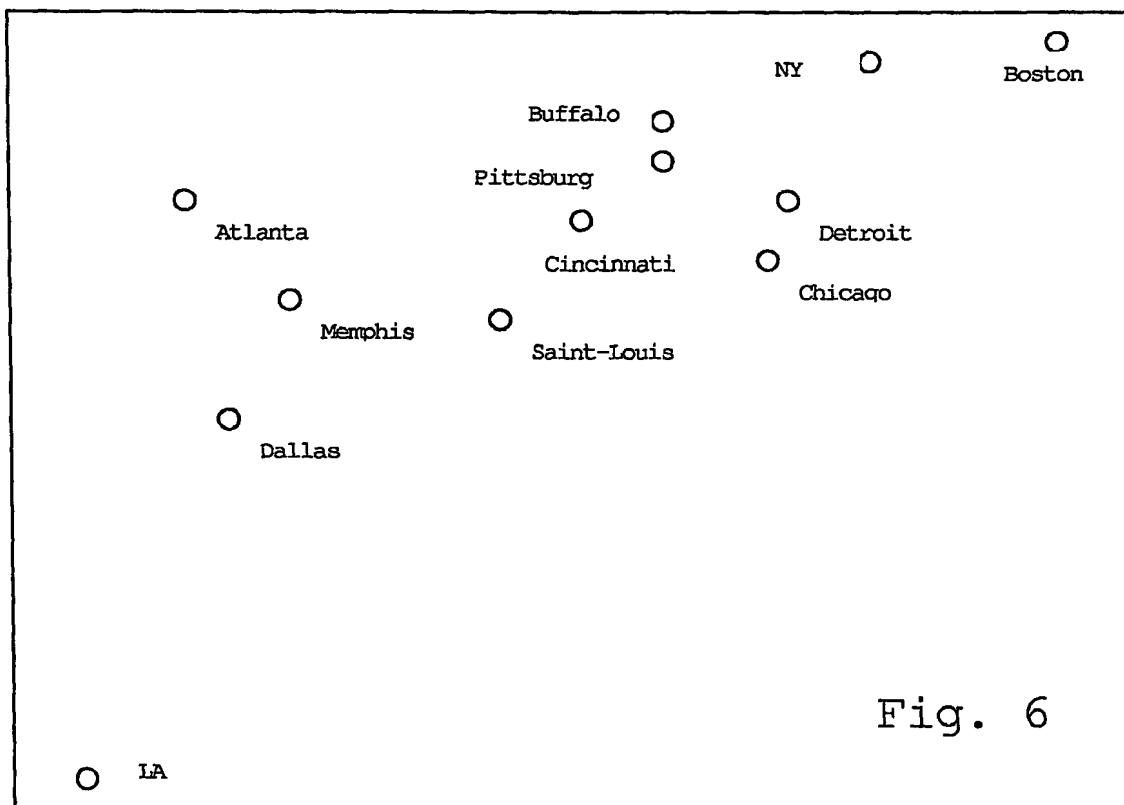


Fig. 6

# Example 3

|               | Cereals | Rice | Potatoes | Sugar | Vegetables | Meat  | Milk  | Butter | Eggs |
|---------------|---------|------|----------|-------|------------|-------|-------|--------|------|
| Belgium       | 72,2    | 4,2  | 98,8     | 40,4  | 103,2      | 102   | 80    | 7,7    | 14,2 |
| Denmark       | 70,5    | 2,2  | 57       | 39,5  | 50         | 105,8 | 145,2 | 4,1    | 14,3 |
| Germany       | 71,3    | 2,3  | 74,1     | 37,1  | 83,1       | 97,2  | 90,7  | 6,9    | 14,8 |
| Greece        | 109,8   | 5,4  | 90       | 30    | 229,5      | 77,1  | 63,1  | 0,9    | 11,3 |
| Spain         | 71,4    | 5,8  | 107,8    | 26,8  | 191,7      | 102,1 | 98,4  | 0,6    | 15,3 |
| France        | 73      | 4,3  | 78,2     | 34,1  | 95         | 110,5 | 98,9  | 8,9    | 15   |
| Ireland       | 93,4    | 3,2  | 151,5    | 34,8  | 55         | 105   | 185,9 | 3,4    | 11,4 |
| Italy         | 110,2   | 4,8  | 38,6     | 27,9  | 181,9      | 88    | 65    | 2,4    | 11,1 |
| Netherlands   | 54,6    | 5    | 86,7     | 39,7  | 99         | 89,4  | 136,2 | 5,4    | 10,7 |
| Portugal      | 86      | 5,7  | 106,6    | 29,4  | 100        | 75,5  | 96    | 1,5    | 7,7  |
| Great Britain | 74,3    | 4,5  | 94,1     | 39,8  | 60         | 74,4  | 129,3 | 3,2    | 10,8 |
| Austria       | 68,7    | 4,2  | 62,6     | 37,1  | 81,9       | 93,4  | 121,3 | 4,3    | 13,4 |
| Finland       | 70,1    | 5,4  | 61,6     | 35,7  | 52,6       | 65    | 208,4 | 5,8    | 10,9 |
| Iceland       | 79,7    | 1,9  | 50,2     | 54,9  | 50         | 71,7  | 205,6 | 4,6    | 11,3 |
| Norway        | 76,9    | 3,5  | 73,2     | 37,3  | 48,3       | 54,9  | 176,5 | 2,1    | 11,3 |
| Sweden        | 69,3    | 4,3  | 70       | 37,5  | 48,5       | 60,5  | 154,1 | 5,7    | 12,9 |

European  
Countries  
Food  
Consumption in  
1994:  
  
9 variables  
16  
observations

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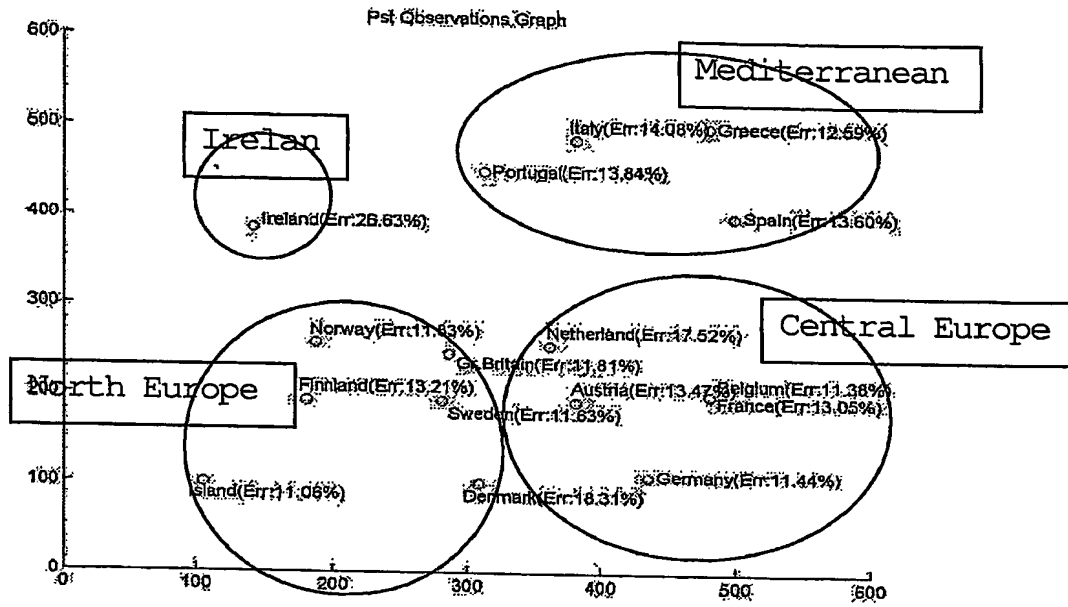


Fig. 8

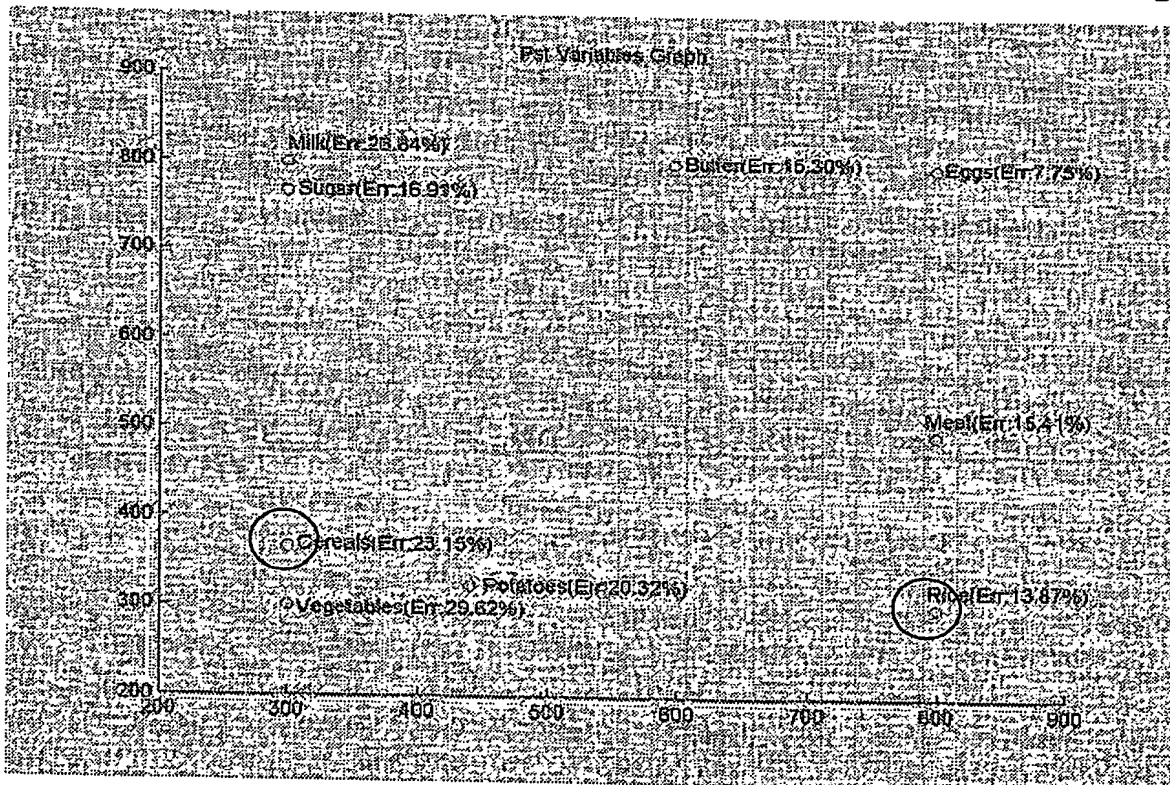


Fig. 9

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| Variables |                 | Complement        |
|-----------|-----------------|-------------------|
| 1         | AgeExam         | 1-AgeExam         |
| 2         | AgeDeath        | 1-AgeDeath        |
| 3         | EdYears         | 1-EdYears         |
| 4         | ADL             | 1-ADL             |
| 5         | WRCL            | 1-WRCL            |
| 6         | CNPR            | 1-CNPR            |
| 7         | BOST            | 1-BOST            |
| 8         | VRBF            | 1-VRBF            |
| 9         | MMSE            | 1-MMSE            |
| 10        | TangleNeocortex | 1-TangleNeocortex |
| 11        | TangleHippo     | 1-TangleHippo     |
| 12        | PlaqueNeocortex | 1-PlaqueNeocortex |
| 13        | PlaqueHippo     | 1-PlaqueHippo     |

Fig. 10

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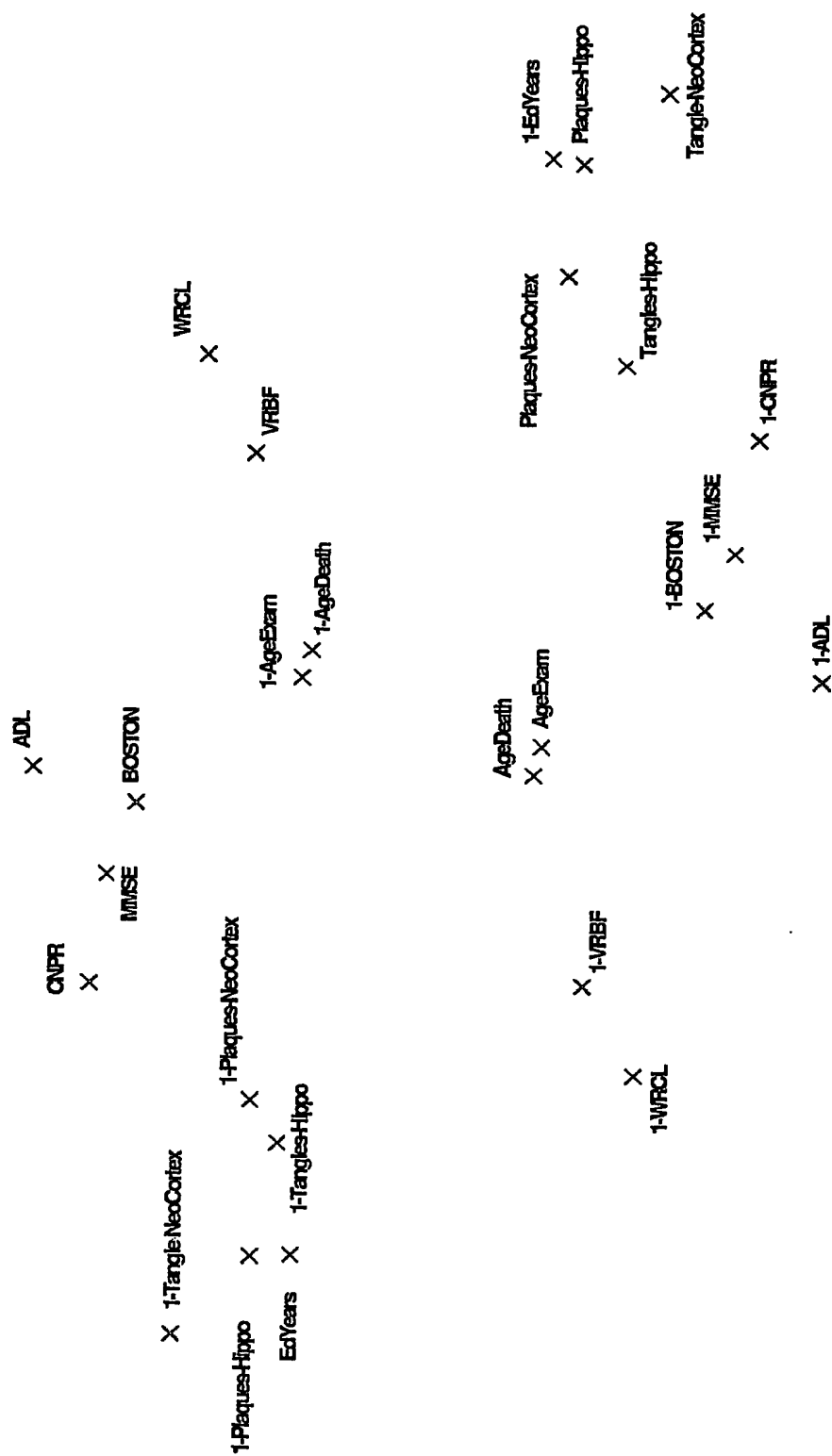


Fig. 11

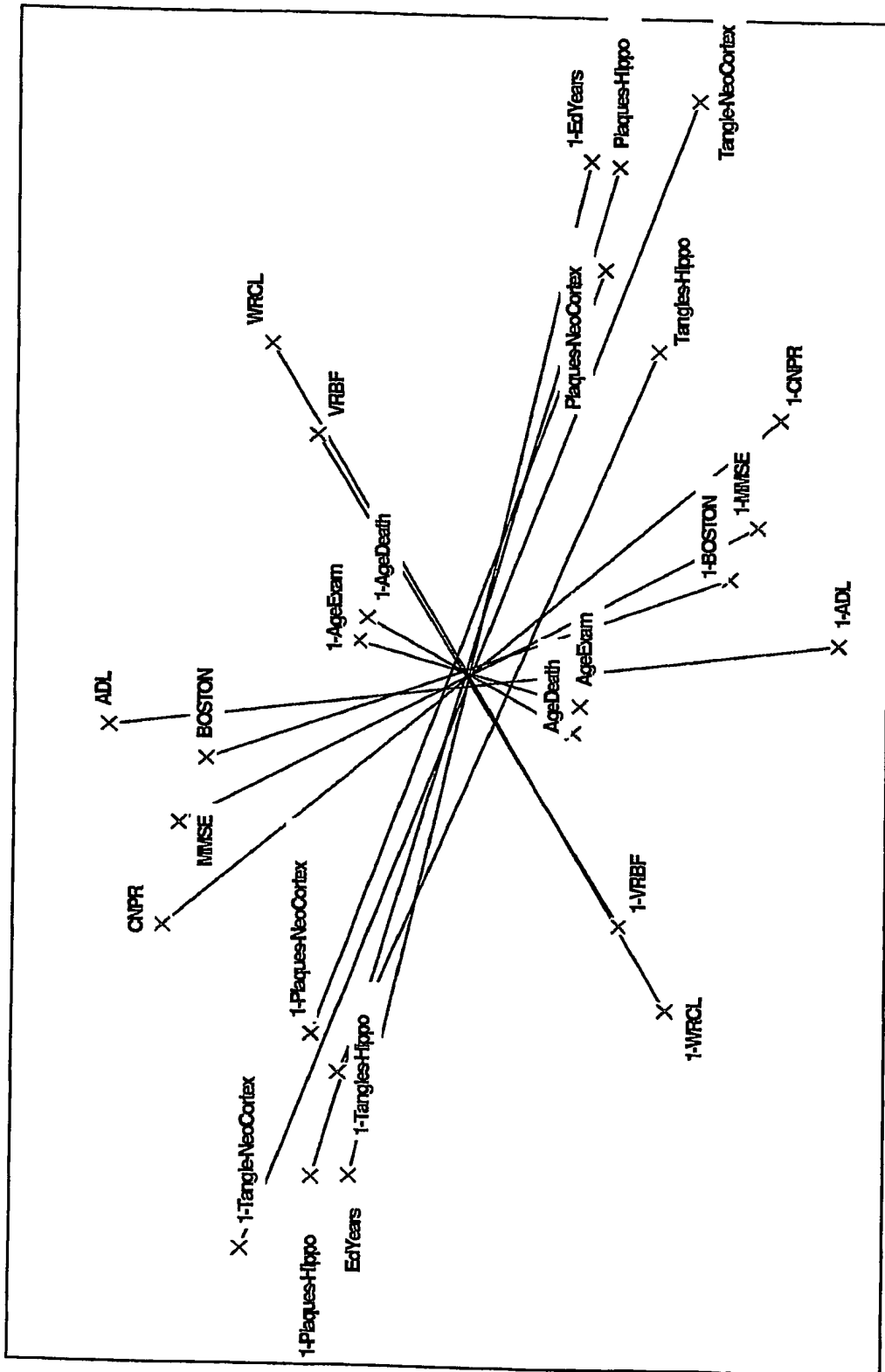


Fig. 12



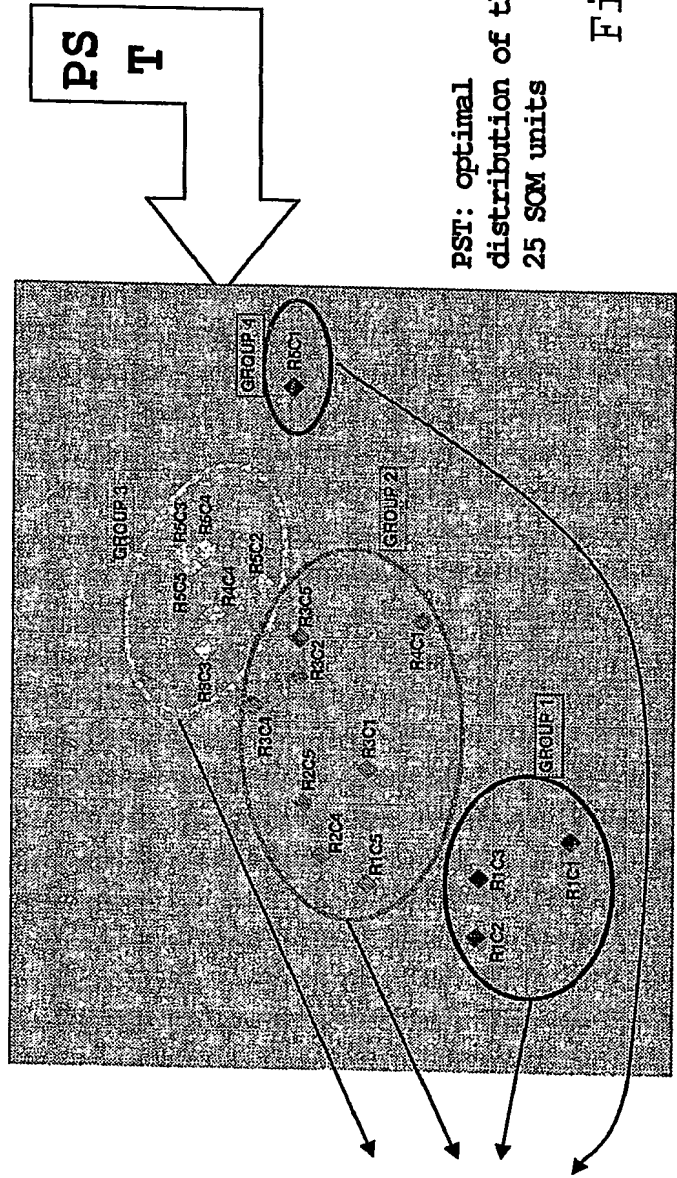
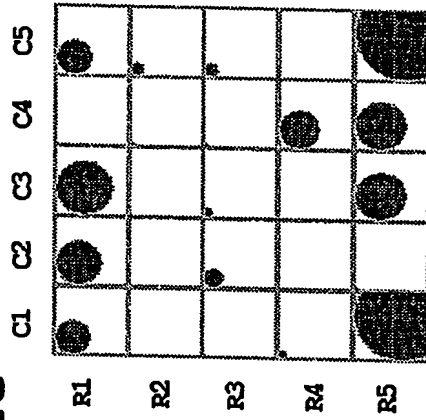
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# Explorative hypothesis of Natural Clustering : Procedure

Self-Organizing Maps (SOM)

Distribution of Subjects in a SOM Map (25 units)

| Variables         |
|-------------------|
| Age_last_exam     |
| Age_death         |
| Education_Years   |
| Walk              |
| Dress             |
| Stand             |
| Toilet            |
| Eat_Drink         |
| WRCL              |
| CNPR              |
| BOSTON            |
| VRBF              |
| MMSE              |
| Apolipoprotein_E4 |
| Score_Athero      |
| TC-NeoCortex      |
| TC-Hippocampus    |
| PC-NeoCortex      |
| PC-Hippocampus    |



Codebooks  
Prototype:  
average of all  
codebooks that  
takes part of each  
group

PST: optimal  
distribution of the  
25 SOM units

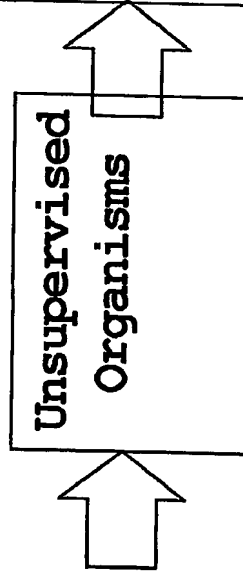
Fig. 13

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# Explorative hypothesis of Natural Clustering

Codebooks Prototype of each Group

| Variables          | Group-1 | Group-2 | Group-3 | Group-4 |
|--------------------|---------|---------|---------|---------|
| Age_last_exam      | 90,7579 | 89,3621 | 84,9923 | 88,1756 |
| Age_death          | 91,4622 | 90,1110 | 86,0971 | 89,1812 |
| Education_Years    | 14,5917 | 14,2293 | 15,2572 | 16,0271 |
| Walk               | 0,0605  | 0,5899  | 0,9713  | 0,9768  |
| Dress              | 0,0453  | 0,4409  | 0,9791  | 0,9466  |
| Stand              | 0,0652  | 0,5912  | 0,9913  | 1,0000  |
| Toilet             | 0,0041  | 0,1725  | 0,9560  | 0,9780  |
| Eat_Drink          | 0,0280  | 0,6173  | 0,8813  | 0,9347  |
| WRCL               | 0,2860  | 2,2480  | 5,3737  | 3,4404  |
| CNPR               | 2,5170  | 8,0884  | 9,5579  | 9,6409  |
| BOSTON             | 3,1969  | 9,4987  | 11,8490 | 10,6115 |
| VRBF               | 1,9532  | 7,3083  | 12,2307 | 12,5998 |
| MMSE               | 4,7406  | 17,5601 | 25,7396 | 23,2561 |
| Apolipoprotein_E4  | 0,3323  | 0,1622  | 0,0076  | 0,8658  |
| Score_Athero       | 0,4845  | 0,4546  | 0,3899  | 0,5456  |
| TC-NeoCortex       | 15,5941 | 7,7160  | 0,9555  | 7,2049  |
| TC-Hippocampus     | 39,0581 | 33,3978 | 11,9865 | 31,9796 |
| PC-NeoCortex       | 8,2940  | 5,7019  | 3,6005  | 6,3076  |
| PC-Hippocampus     | 4,0608  | 3,0796  | 0,9535  | 5,1484  |
| Number of subjects | 27      | 22      | 50      | 18      |
| Number of Demented | 25      | 14      | 6       | 1       |
| Demented in %      | 92,59%  | 63,64%  | 12,00%  | 5,56%   |
| Number of MCI      | 1       | 6       | 15      | 7       |
| MCI in %           | 3,70%   | 27,27%  | 30,00%  | 38,89%  |



| Variables         |
|-------------------|
| Age_last_exam     |
| Age_death         |
| Education_Years   |
| Walk              |
| Dress             |
| Stand             |
| Toilet            |
| Eat_Drink         |
| WRCL              |
| CNPR              |
| BOSTON            |
| VRBF              |
| MMSE              |
| Apolipoprotein E4 |
| Score_Athero      |
| TC-NeoCortex      |
| TC-Hippocampus    |
| PC-NeoCortex      |
| PC-Hippocampus    |

Fig. 14

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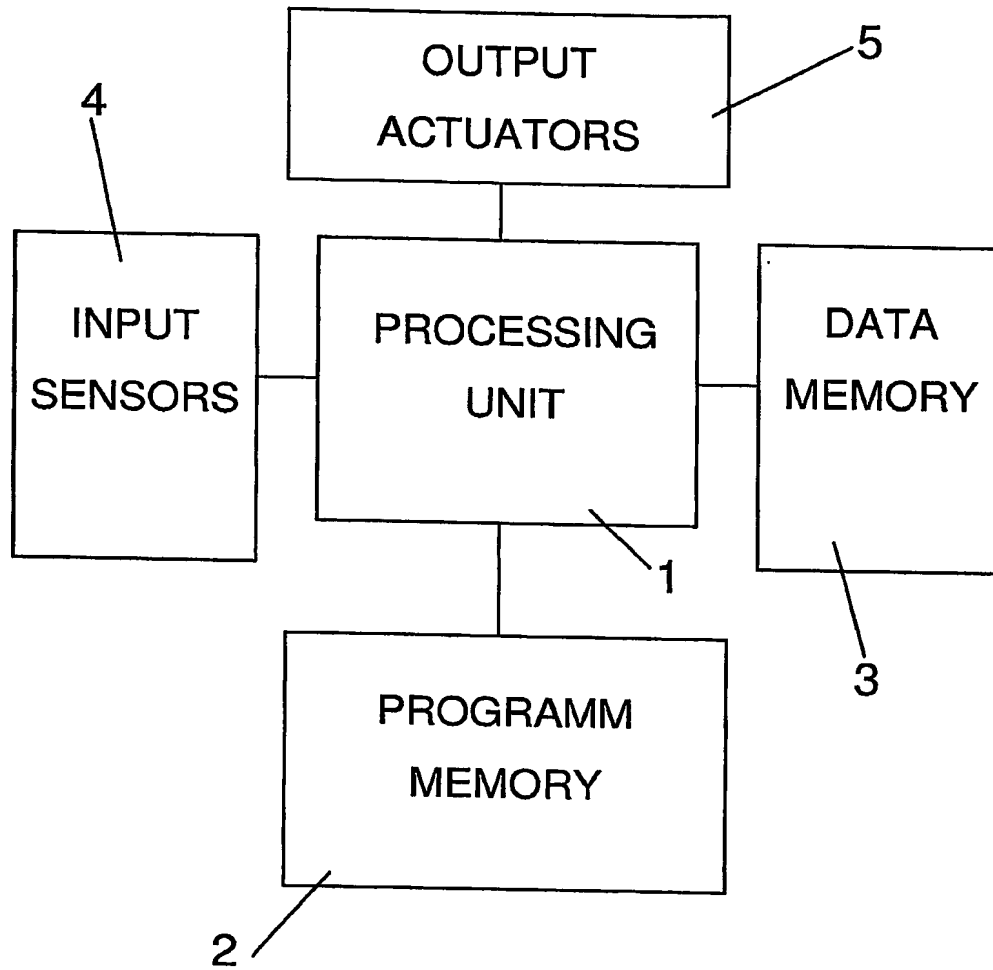
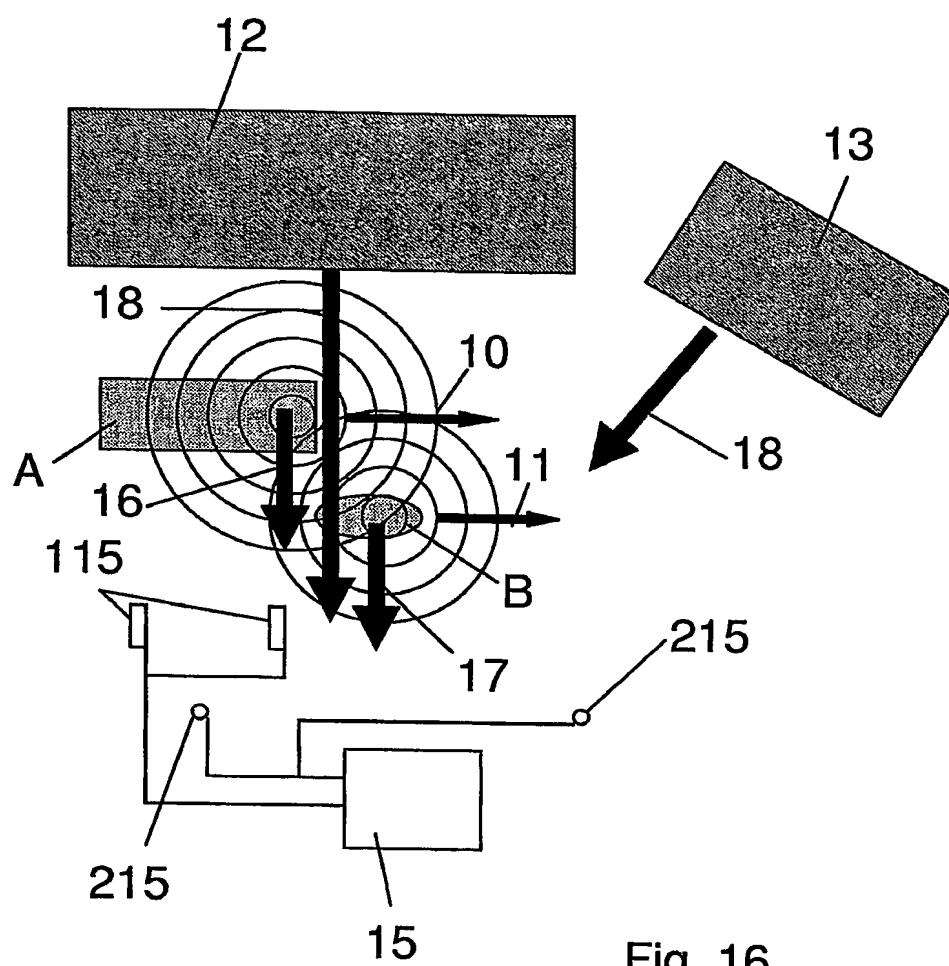


Fig. 15

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**Fig. 16**

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Distances between atoms ((-1) indicates lacking information about distances)

| At.1  | At.2 | At.3 | At.4 | At.5 | At.6 | At.7 | At.8 | At.9 | At.10 | At.11 | At.12 | At.13 | At.14 | At.15 | At.16 | At.17 | At.18 | At.19 | At.20 | At.21 | At.22 | At.23 | At.24 | At.25 |
|-------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| At.1  | 0    | -1   | -1   | 480  | -1   | -1   | -1   | -1   | -1    | -1    | 220   | 407   | -1    | -1    | -1    | 688   | -1    | -1    | -1    | 636   | -1    | -1    | -1    | -1    |
| At.2  | -1   | 0    | -1   | -1   | 265  | -1   | -1   | -1   | -1    | -1    | -1    | -1    | -1    | -1    | 307   | 188   | -1    | -1    | -1    | -1    | -1    | -1    | -1    | 345   |
| At.3  | -1   | -1   | 0    | -1   | 474  | -1   | -1   | -1   | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | 400   | 554   | -1    | -1    | 572   | -1    |
| At.4  | 480  | -1   | 0    | -1   | 0    | 238  | -1   | -1   | -1    | -1    | 670   | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | 350   | -1    |
| At.5  | -1   | 265  | 474  | 238  | 0    | -1   | -1   | -1   | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    |
| At.6  | -1   | -1   | -1   | -1   | -1   | 0    | -1   | 247  | -1    | -1    | -1    | 528   | -1    | -1    | -1    | -1    | -1    | -1    | 341   | -1    | -1    | -1    | -1    | 179   |
| At.7  | -1   | -1   | -1   | -1   | -1   | 0    | 168  | -1   | -1    | -1    | -1    | -1    | 144   | -1    | 567   | -1    | -1    | -1    | 194   | 376   | -1    | -1    | -1    | -1    |
| At.8  | -1   | -1   | -1   | -1   | -1   | -1   | 247  | 168  | 0     | -1    | -1    | -1    | 222   | -1    | -1    | -1    | 418   | -1    | -1    | -1    | -1    | -1    | -1    | -1    |
| At.9  | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | 0     | -1    | -1    | 160   | -1    | 79    | -1    | -1    | -1    | -1    | -1    | -1    | 637   | -1    | -1    | -1    |
| At.10 | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1    | 0     | -1    | 463   | -1    | -1    | -1    | -1    | -1    | 320   | 123   | -1    | 236   | -1    | -1    | -1    |
| At.11 | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | 289   | 0     | -1    | -1    | -1    | -1    | -1    | -1    | 692   | -1    | -1    | -1    | -1    | -1    | -1    | 218   |
| At.12 | 220  | -1   | -1   | 670  | -1   | -1   | -1   | -1   | -1    | -1    | 0     | -1    | -1    | 515   | -1    | 695   | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    |
| At.13 | 407  | -1   | -1   | -1   | -1   | 528  | -1   | -1   | 160   | 463   | -1    | 0     | -1    | 286   | -1    | -1    | -1    | 383   | -1    | -1    | -1    | -1    | -1    | -1    |
| At.14 | -1   | -1   | -1   | -1   | -1   | -1   | 144  | 222  | -1    | -1    | -1    | -1    | 0     | 220   | 548   | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    |
| At.15 | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1    | -1    | 515   | 286   | 220   | 0     | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    |
| At.16 | -1   | 307  | -1   | -1   | -1   | -1   | 567  | -1   | -1    | -1    | -1    | -1    | 548   | -1    | 0     | -1    | -1    | -1    | 521   | -1    | -1    | 913   | -1    | -1    |
| At.17 | 688  | 188  | -1   | -1   | -1   | -1   | -1   | -1   | -1    | -1    | 695   | -1    | -1    | -1    | -1    | 0     | 716   | 543   | -1    | -1    | -1    | -1    | -1    | -1    |
| At.18 | -1   | -1   | -1   | -1   | -1   | -1   | -1   | 418  | -1    | -1    | 692   | -1    | -1    | -1    | -1    | 716   | 0     | -1    | -1    | -1    | -1    | -1    | -1    | -1    |
| At.19 | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1    | 320   | -1    | -1    | -1    | -1    | -1    | -1    | -1    | 0     | 250   | -1    | -1    | 614   | 564   | -1    |
| At.20 | -1   | -1   | 400  | -1   | -1   | -1   | 194  | -1   | -1    | 123   | -1    | -1    | -1    | -1    | 521   | -1    | -1    | 250   | 0     | -1    | -1    | -1    | -1    | -1    |
| At.21 | 636  | -1   | 554  | -1   | -1   | -1   | 376  | -1   | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | 0     | -1    | 353   | -1    | -1    |
| At.22 | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1    | 637   | 236   | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | 0     | 403   | -1    | -1    |
| At.23 | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1   | -1    | -1    | -1    | -1    | -1    | -1    | 913   | -1    | -1    | -1    | -1    | 353   | 403   | 0     | -1    | -1    |
| At.24 | -1   | -1   | 572  | 350  | -1   | -1   | -1   | -1   | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | 564   | -1    | -1    | -1    | -1    | 0     | -1    |
| At.25 | -1   | 345  | -1   | -1   | -1   | 179  | -1   | -1   | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | -1    | 0     |

Fig. 17

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TWO DIMENSIONAL MAP

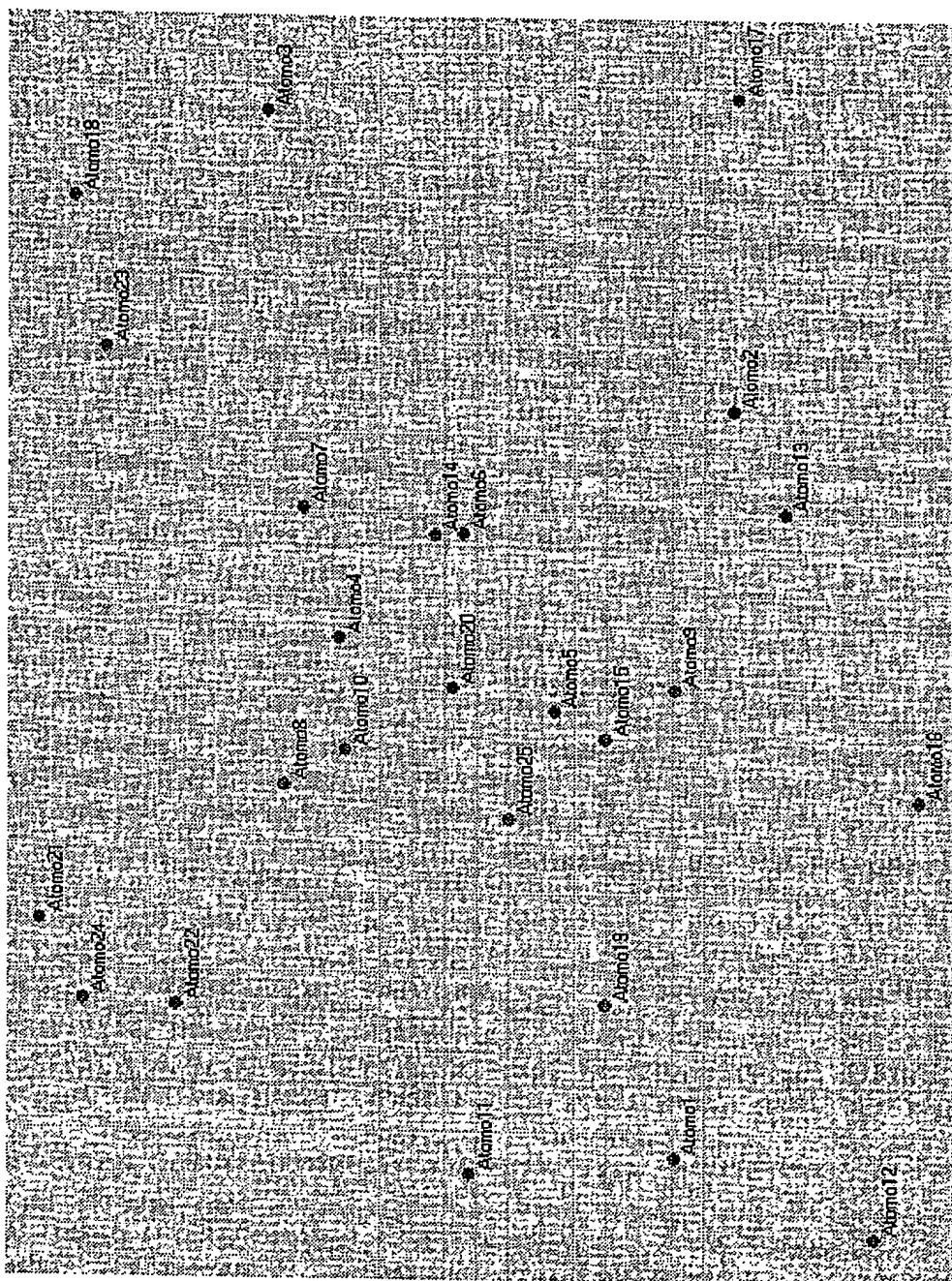


Fig. 18

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THREE DIMENSIONAL MAP

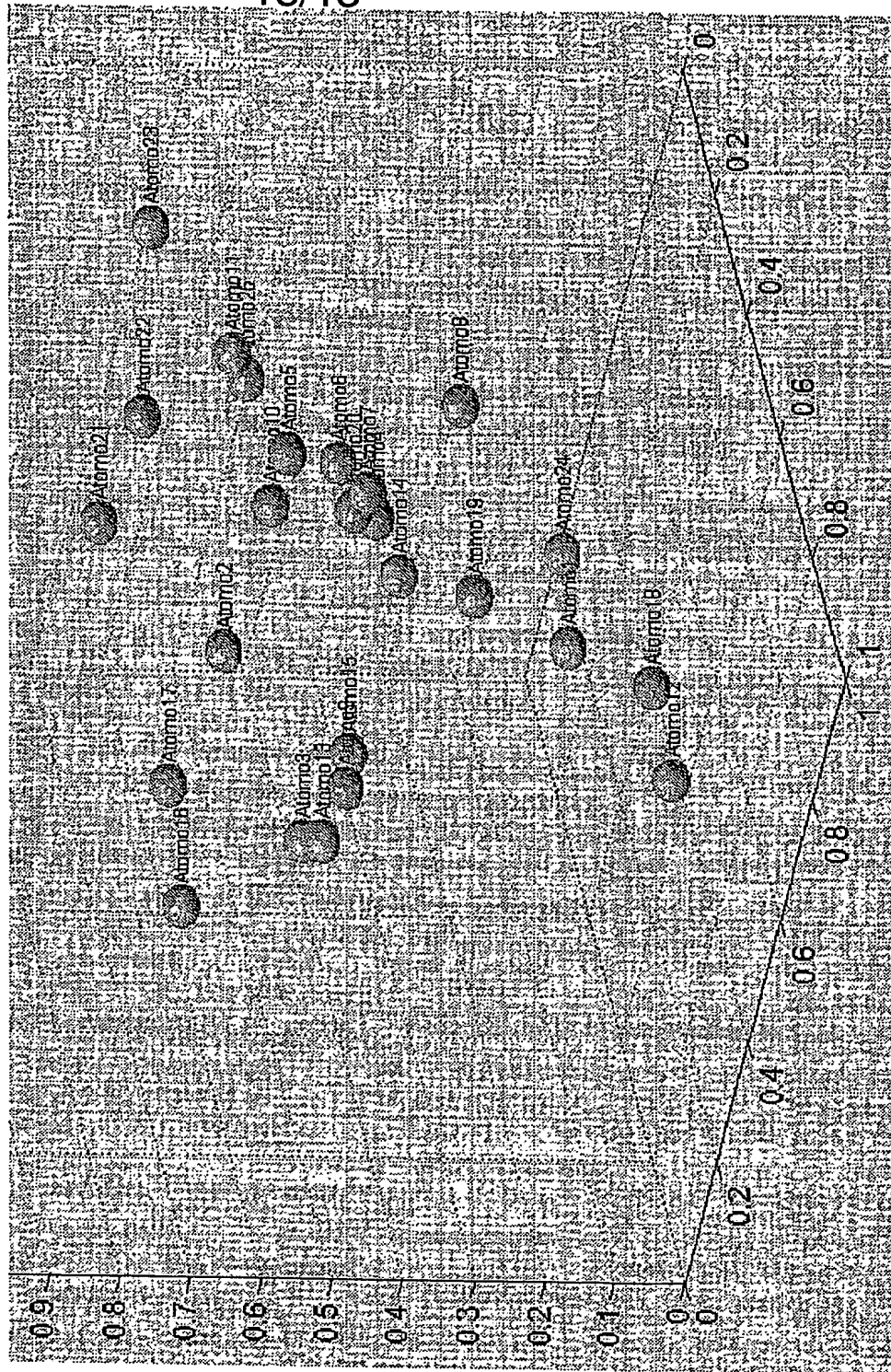


Fig. 19